Tense and Aspect in English and French

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Frequency Adverbs, Temporal Adverbial Clauses, and DRT[1]

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1 Introduction

In this short paper, I will discuss a small group of English temporal adverbs usually referred to as frequency adverbs. Among them are *always*, *often*, *usually*, and *seldom*. Lewis(1975) refers to them as adverbs of quantification. According to Lewis, an adverb of quantification is an unselective quantifier in that it binds an unlimited number of distinct variables, unlike selective quantifiers such as $\exists$ and $\forall$. This idea was adopted in DR theory (Kamp(1981), Heim(1982) etc.) as is well-known.
Lewis(1975)

considers some sentences involving an adverb of quantification. Among them are the following:

(1) a. Riders on the Thirteenth Avenue line seldom find seats.
b. A quadratic equation usually has two different solutions.

Lewis suggests two *prima facie* plausible analyses of these frequency adverbs:

1. they are quantifiers over times;
2. they are quantifiers over events.

Lewis argues that (1.a) disproves the first analysis because the entities that the adverb *seldom* quantifies over, i.e. riders on the thirteenth avenue, are not evenly distributed over the time continuum. Therefore, letting *seldom* quantify over intervals at which someone is a rider of the subway results in the wrong predictions. Shall we say, then, that *seldom* as used in (1.b) quantifies over events of someone's riding the train on the thirteenth avenue line? Lewis thinks that this is wrong as well. As (1.b) shows, frequency adverbs can be used to talk about entities which have no location in time and do not participate in events. (1.b) simply means "most quadratic equations have two different solutions". Having considered examples such as (1.a) and (1.b), Lewis suggests that frequency adverbs (or *adverbs of quantification* in Lewis' terms) are quantifiers over

[1]I thank Hans Kamp, Walter Kasper, and Marc Moens for discussion and/or valuable suggestions. I also wish to acknowledge the following three talks on temporal semantics given during the European Summer School held in Leuven, Belgium: those by Hans Kamp, Henriette de Swart, and Alex Lascarides. Those talks motivated me to work on this paper. Of course, all errors are my own.

"cases". In the theory Lewis advocates, a case is the "tuple of the participants", which are values of the variables that occur free in the open sentence modified by the adverb Lewis(1975), p. 7. The interpretation rules for structures of the form

Adv.-of-Q [S_1, S_2]

can be given in the following way:

(2) a. *Always*$[\psi, \phi]$ is true iff every assignment to the free variables in ψ which makes ψ true also makes ϕ true.

b. *Usually/Often*$[\psi, \phi]$ is true iff more than fifty percent of the assignments to the free variables in ψ which make ψ true also make ϕ true.

c. *Seldom*$[\psi, \phi]$ is true iff few assignments to the free variables in ψ which make ψ true also make ϕ true.

Let us see how these semantic rules account for the basic examples. One provision should be added here concerning the above interpretation rules. I assume that if a new variable is introduced in the consequent part (but not in the antecedent part), the variable is not caught by the adverb of quantification, and it is existentially closed within the consequent clause. In order to bring about this effect, I will actually write in an existential quantifier in the consequent clause when necessary. This allows me to adopt the above simple semantic rules for adverbs of quantification, at least for the purpose of this paper.

If the surface form of the sentence does not look as if it contains any free variable, its logical representation could be assumed to contain a free time variable. For example, (3.b) would be one way of representing the semantic structure of (3.a):

(3) a. Caesar seldom awoke before dawn.

b. *Seldom* [Caesar awakes at $t \wedge t$ precedes the speech time, (Caesar awakes at $t \wedge t$ precedes the speech time $\wedge$) t is before dawn]

(4.a), on the other hand, requires a more complex treatment:

(4) a. Riders on the Thirteenth Avenue line seldom find seats.

b. *Seldom* [x rides a train on the Thirteenth Avenue line at t, x occupies a seat at t]

c. *Seldom* [e is someone's riding a train on the Thirteenth Avenue line, e is someone's riding a train on the Thirteenth Avenue line seated]

I offer two possibilities here:

1. *seldom* quantifies over rider-time pairs as in (4.b);

2. *seldom* quantifies over events as in (4.c).

Lewis' mathematical example (5), however, does not seem to involve time intervals or events:

(5) A quadratic equation usually has two different solutions.

(5) means that the majority of quadratic equations have two different solutions, and this interpretation obviously does not involve times or events, at least not in an obvious way. Thus, Lewis suggests that in this example, the relevant "cases" are quadratic equations:

(6) *Usually* [x is a quadratic equation, x has two different solutions]

Lewis(1975)

, p. 9 also suggests that a "case" involved in (7.a) is a triple consisting of a variable for a man, a variable for a donkey, and a time variable. In our formalism, Lewis' idea can be represented as in (7.b):

(7) a. Always, if x is a man, if y is a donkey, and if x owns y, x beats y now and then.

b. *Always* [x is a man $\wedge y$ is a donkey $\wedge x$ owns y at t, x (habitually) beats y at t]

(Let us not worry, for the moment, what *at t* in (7.b) should be taken to mean.) The DRT literature on nominal anaphora usually abstracts away from time-related complications. That is, the logical representation of (8.a) is assumed to be (8.b):

(8) a. If a man owns a donkey, he always beats it.

b. *Always* [x is a man $\wedge$ y is a donkey $\wedge$ x owns y, x beats y]

However, as we shall see, times play an important role and cannot be ignored when we consider more complex examples involving donkey anaphora.

In what follows, I will attempt to investigate for a limited domain the function of adverbs of quantification. I restrict my attention to those cases where an adverb of quantification occurs with a temporal adverbial clause headed by *when*, *before*, or *after*. What I will claim in this paper can be summed up as follows: As far as the examples involving temporal adverbial clauses are concerned, adverbs of quantification seem to quantify over a set of intervals or "situations"[2] which cannot be derived in a straightforward way from the known syntactic and semantic properties of the sentence. That is, we cannot explain

[2]The word "situation" as it is used in this paper should be taken as a non-technical term.

the behavior of adverbs of quantification simply by making them selective quantifiers[3]. In this paper, I will not attempt to provide a solution to the problem that I will discuss. The point of this paper is to present a problem which suggests the possibility that there may be a different way of addressing the problems associated with classical DRT, in particular the proportion problem (Kadmon(1987), etc.).

Now, let us see how sentences with a temporal adverbial clause and an adverb of quantification are analyzed by the rules given in (2). Consider the following examples:

(9) a. When John calls up Mary, she is always busy.
b. When John throws a party, Mary always shows up.

I assume, tentatively, that (9.a) and (9.b) have the following logical representations:

(10) a. *Always* [John calls up Mary at t, she is busy at t]
b. *Always* [John throws a party at t, Mary shows up at t]

The unselective quantifier analysis of *always* provides (9.a) and (9.b) with the right interpretations. (9.a) is predicted to be true if and only if the set of times at which John calls up Mary is included in the set of times at which she is busy, and similarly for (9.b). Although the semantics of *when*-clauses is actually more complex than what this simple generalization indicates, the above truth conditions give us roughly the right results for the examples considered here.

2 Examples without Adverbs of Quantification

Let us set aside examples involving frequency adverbs, and consider first non-quantificational examples, i.e. sentences of the form "When/Before/After S_1, S_2" in which each clause describes one single event. Let us consider *when* first. The simplest assumption that we can make about the semantics of *when*-clauses is that the event in the *when*-clause and the event in the main clause are contemporaneous. This is what we assumed above for the examples (9.a) and (9.b). However, this is empirically inadequate. One alternative idea presented within the confines of traditional model-theoretic semantics is that when the main clause has an event sentence and the *when*-clause also has an event sentence (in particular, an achievement sentence), the main clause event is understood to follow the event described by the *when*-clause (Vlach(1981)).[4] In the DRT literature, there are two different ideas as to how *when*-clauses should be analyzed. Hinrichs(1981), Hinrichs(1986) contends that there is no predetermined temporal order between the event described by a *when*-clause and the one described by a main clause.

[3]It is possible that the situation is completely different with *if*-clauses, which I will not deal with in this paper.

[4]On the other hand, when the main clause contains a stative sentence, the event described there is assumed to overlap the event described in the adverbial clause.

A *when*-clause introduces a reference time and the two events in question are located within this reference time. Hinrichs(1986), p. 75 considers the following examples:

(11) a. John broke his arm when he wrecked the Pinto.

b. When the Smiths moved in, they threw a party.

c. When the Smiths threw a party, they invited all their old friends.

These examples suggest that there is no predetermined temporal order between the two events in question, even though they are required to be temporally close to each other[5]. Partee(1984) takes a different position. Her proposal is to introduce a new reference time "just after" the *when*-clause event. The event described by the main clause is located within this new reference time. She acknowledges that Hinrichs' proposal covers more cases, but she says that her proposal "gives a more unified account of the introduction of reference times in the linear case (p. 261)."[6]

Perhaps, no such "temporal proximity constraint" is imposed on *before* or *after* when the temporal adverbial clause and the main clause describe a single event each. For example, it does not look as if the two events described in (12) have to be temporally close to each other:

(12) John entered college before Mary did.

In some cases, however, temporal proximity seems to play a role in determining the truth conditions (or perhaps felicity conditions) for sentences involving *before* or *after* . Consider the following example:

(13) John had breakfast before going to bed (*or* before he went to bed).

It would be odd to utter (13) in the following situation: one day John woke up at seven. He had breakfast, went to work, returned to his apartment at eight in the evening, and went to bed at eleven. Assume that he had lunch and dinner in the meantime. It is true that John's having breakfast temporally precedes his going to bed, but (13) sounds like a very misleading statement, given what John did on that day. Perhaps, the fact that John had two other meals in between has something to do with the strangeness associated of (13). Or perhaps (13) is odd because it is not very informative to say that having breakfast in the morning precedes going to bed at night. Although it is not easy to pinpoint the exact source of the problem, it is arguable that even if we restrict our attention to non- quantificational cases *before*- and *after*- clauses constrain the temporal distance between the two events involved. For the purpose of this paper, however, we can simply leave this issue open because my main contention to be presented later concerns quantificational cases, not non-quantificational cases.

[5]Lascarides (1990) claims that this is the right thing to say for English, and proposes a formal framework which accounts for the actual order of the events by incorporating some information about pragmatics.

[6]See also Schubert/Pelletier(1989) on this issue.

3 Adverbs of Quantification and Temporal Adverbial Clauses

As mentioned above, some authors such as Partee(1984) assume that we need two different reference times for the event described by the adverbial clause and the one described by the main clause. When the adverbial clause is headed by *when*, the second reference time established for the main clause event is "just after" the adverbial event. This account is not executed formally in Partee(1984), but the idea is clear: the event in the *when*-clause event establishes a unique reference time for the main clause event. Partee assumes that this function of *when*-clauses carries over to quantificational cases. Consider (14).

(14) a. When John telephoned Dr. Jones, his secretary always answered.

b. *Always* [e is John's telephoning Dr. Jones and t is immediately after e, there is an event of his secretary's answering which obtains within t]

The interpretation of (14.b) is that for each pair $\langle e, t\rangle$ such that e is an event of John's telephoning Dr. Jones and t is the time immediately after e, *there is* an event of his secretary's answering located within t. It is assumed here that each event of John's telephoning Dr. Jones is matched up with a unique time interval because the interval assigned to t is the time "immediately after" e. As desired, (14.a) is interpreted to mean that for each event of John's telephoning Dr. Jones, there is an event of his secretary's answering which immediately follows it.

Partee notes, however, that it is not possible to extend her idea to examples involving *before* and *after*. Consider the following example, which is discussed by Partee(1984), p. 273:

(15) Before John makes a phone call, he always lights up a cigarette.

Partee observes that introducing in the "antecedent box" a reference time for the event in the main clause would result in the interpretation that John lights up a cigarette *at all times* preceding each phone call, rather than that he lights a cigarette *sometime* before each phone call:

(16) *Always* [x = John $\wedge$ y is a phone call $\wedge$ e is x's making $y\wedge$ t precedes e, there is an e' such that z is a cigarette $\wedge$ e' is x's lighting up $z\wedge$ e' obtains within t]

Since the second reference time is introduced in the "antecedent box" as a free time variable, it is caught by the unselective quantifier *always*. Note here that t is only required to precede e. Therefore, for a given value of e, there are many possible values for the variable t. In fact, all the intervals which precede the interval occupied by the value assigned to e would qualify as a value for t. This leads to the erroneous interpretation mentioned above. One possible solution to this problem suggested by

Partee is to introduce the reference time in the consequent part, rather than in the antecedent part. However, if we introduce a new time and/or event in the consequent part, a new problem arises. Consider the following representation:

(17) *Always* [x = John $\wedge$ y is a phone call $\wedge$ e is x's making y, there is a t such that t precedes $e\wedge$ z is a cigarette $\wedge$ e' is x's lighting up $z\wedge$ e' obtains at t]

This produces the problem that one single event of John's lighting up a cigarette which precedes all events of John's making a phone call is enough to make the sentence true.

4 Some General Problems with the Original DRT Approach

The recent literature on DRT made clear that the unselective quantifier approach that the original DRT approach adopted has many problems. One such problem is the so-called "proportion problem" (Kadmon(1987)), which is exemplified by the following sentence:

(18) Most women who own a dog are happy.

According to the original DRT approach, this sentence is predicted to be true if and only if the following conditions are satisfied:

(19) For most of the pairs $< x, y >$ such that x is a woman and y is a dog that x owns, x is happy.

However, (19) gives us the wrong result in the following situation: there is a woman who owns fifty dogs and is happy, and there are nine other women who own one dog each and are unhappy. Intuitively, (18) is false under the situation just described, but the truth conditions given above predict that it is true. The problem is that the adverb quantifies over woman-dog pairs. It seems that the quantifier must only bind the variable for women, and not the one for dogs.

This problem has a temporal analogue. Kadmon(1987) credits Bäuerle/Egli(1985) for noting this fact. Consider the following example:

(20) a. When an aunt comes, I usually go to the cinema.

b. *Usually* [x is an aunt $\wedge$ x comes at t, I go to the cinema at t][7]

[7]Strictly speaking, translating the main clause as "I go to the cinema at t" is problematic because the time of an aunt's coming and my going to the cinema are not simultaneous.

If *usually* quantifies over aunt-time pairs, (20.a) is predicted to be false in the following situation: at one time, ten aunts came together and I did not go to the cinema, but ten other times a single aunt came, and I did go to the cinema. This prediction goes against the native speaker's intuitions. What we need here is quantification over intervals at which some aunt comes, not over interval-aunt pairs.

There is another version of the proportional problem which involves temporal elements. Consider the following example, which is due to Kamp(1990):

(21) In the 70s I lived in France. When I was in Paris, I often paid a visit to the Louvre.

The second sentence of (21) has several possible interpretations, and I will concentrate upon one of them here: the speaker visited Paris on different occasions in the 70s, and a visit to the Louvre was included in many of his visits to Paris. Note that this interpretation cannot be obtained by positing the following logical representation:

(22) *Often* [I am in Paris at t, I pay a visit to the Louvre sometime within t]

In the literature which deals with verbal aspect, it is usually assumed that stative sentences such as *I am in Paris* has the following property, which is called the subinterval property.

(23) For all p and t such that p is a stative sentence and t is a time interval, if p is true at t, p is also true at any of the (proper) subintervals of t.

If this assumption is correct, and if time is dense, we are led to the conclusion that there are an infinite number of intervals which satisfy the variable t of the above formula (assuming that the speaker visited Paris at least once). It is easy to see, then, that the condition given in the consequent cannot be satisfied. It seems that we must impose the following restriction upon the possible values of t: there is no interval t' which properly contains t and the same proposition is true at t'. Intuitively, what this does is to collect the "maximal" intervals at which the proposition is true, but I do not know if this restriction can be imposed in a principled way.

Another problem was pointed out by Schubert/Pelletier(1989), p. 200, who discuss the following example:

(24) If I have a quarter in my pocket, I will put it in the parking meter.

The DRT semantics requires that the speaker put *all* the quarters that he has in his pocket into the parking meter. However, our intuitions tell us that putting one quarter, if I have any, is sufficient to guarantee the truth of the sentence. Schubert and Pelletier account for the asymmetric reading for the quantificational version of (24), i.e. (25), by assuming that *always* can serve as a selective quantifier which "controls" only the time

variable (p. 245).

(25) If a man has a quarter in his pocket, he always puts it in the parking meter.

It seems, then, that adverbs of quantification behave like selective quantifiers at least in some cases.

5 A New Type of Proportion Problem

The above discussion might give the reader the impression that the proportional problem could be solved by making the adverb a selective quantifier and let it bind some, and not all, of the free variables appearing within its scope. However, there are cases which do not admit of such a solution. That is, the quantificational force of the adverb cannot be described correctly simply by turning it into a selective quantifier. Consider the following example, which is just like the example (15) discussed earlier, except that we now have *usually* instead of *always*:

(26) Before John makes a phone call, he usually lights up a cigarette.

For the sake of argument, let us assume here that the problem associated with *before* which we discussed above was solved in some way. One possibility offered here, which is admittedly artificial, is to fix the reference interval in the following way:

(27) *Usually* [x = John $\wedge$ y is a phone call $\wedge$ e is x's making $y\wedge$ t is the thirty-minute interval abutting and preceding e, x's lighting up a cigarette obtains within t]

This completely fixes the reference interval t for a given event of John's making a phone call. Now, (26) is predicted to be false in the following situation: one day John made ten phone calls in a row, and he did not smoke before making them. But on ten other days, he made one phone call per day, and he did smoke beforehand. However, our intuition is that (26) is true under this scenario. It seems that if John makes ten phone calls in a swoop, they count as "one collective event", so to speak, on a par with the other ten phone calls which were made in isolation. And the evaluation of the adverb *usually* must be made in reference to the number of such situations, not in reference to the number of phone-call events *per se*. Note here that it is not sufficient to let *usually* quantify over the set of intervals "at which" a phone call is made because the ten continuous phone-call events occupy different time intervals. Rather, quantification must be made in reference to "situations" each of which includes a phone call event or a set of cohesive phone call events. The problem is that it is not obvious how to derive such "situations" from the syntactic and semantic information available at the surface level. How do we know that the ten phone calls made in a row, but not the other ten phone calls made on ten different days, constitute one unit for the purpose

of quantification? We might say that temporal proximity plays a role here. But this is a rather fuzzy concept, which we would like to avoid as much as possible. At any rate, the above discussion tells us that the objects over which *usually* quantifies may be things that are more abstract than n-tuples of individuals.

A similar problem occurs with *when*. Consider the following example:

(28) When John smokes a cigarette, Mary always puts on her gas mask.

The story is as follows: John is a heavy smoker, and Mary hates cigarette smoke. Therefore, whenever he smokes, she puts on her gas mask in order to protect her health and also to demonstrate how much she hates cigarette smoke. The standard DRT analysis provides us with the following logical representation for (28):

(29) *Always* [x is a cigarette $\wedge$ e is John's smoking $x\wedge$ t is immediately after e, Mary puts on her gas mask at t]

This representation predicts that the sentence is false in the following situation: Whenever John smokes, he smokes many cigarettes, not just one. As soon as he starts smoking, Mary puts on her gas mask, and she does not take it off until he finishes smoking. This is repeated every day. This means that she does not put on her mask every time he starts smoking a new cigarette. However, the judgment seems to be that (28) is true in that situation. If this judgment is correct, *always* does not quantify over individual smoking-a-cigarette events. Instead, it makes reference to "collective smoking events", so to speak, and checks whether there is an event of Mary's putting on her gas mask for each of these collective smoking events. This example is similar in spirit to Schubert and Pelletier's example (25). However, the difference is that (28) requires something more than turning *always* into a selective quantifier. That is where the difficulty lies.

6 Closing Remarks

In this paper, I presented some problems with the idea that the frequency adverbs can be analyzed as unselective quantifiers. In particular, I suggested that at least in some cases adverbs of quantification quantify over intervals or "situations" which cannot be easily derived from the syntactic and/or semantic information available to us. As far as I can see the problem that I discussed is similar to the problem associated with progressives that I touched upon in my last deliverable (Ogihara 1990). Unfortunately, I cannot offer a solution to the problems presented above. However, the new problems that I presented in this paper might suggest that the existing problems of DRT, in particular, the proportion problem, should be looked at from a different perspective.

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